Research Article

Effects of percussive massage treatment with theragun on pain and muscle length on post exercise delayed onset muscle soreness of calf muscles in healthy population

Mahnoor Rao[1], Syed Shakil ur Rehman[2], Danish Hassan[3], Mehwish Ikram[4,*]

ABSTRACT

Background: People who engage in unusually intense or prolonged physical activity frequently experience delayed onset muscle soreness (DOMS). DOMS may be treated using percussion massage therapy, which employs a portable tool to administer quick, repeated strikes to the muscle tissue. While there hasn't been much research done on the effects of Theragun specifically.

Objective: to determine the effects of percussive massage treatment with theragun on pain and muscle length on post-exercise delayed onset muscle soreness of calf muscles in the healthy population.

Methodology: This randomized control trial (NCT05026944) was conducted at Kasrat Health and Fitness Club, Lahore, Pakistan. The study was approved by the research ethical committee of Riphah International University Islamabad (REC/RCR &AHS/21/0410) A total of n=24, healthy females, age ranging from 20-30 years with post-exercise DOMS of calf muscles were included. All the study participants were randomly divided into group A received Percussive Massage Treatment with Theragun in addition to stretching exercises, while group B only received stretching exercises. The outcome variables were pain on NPRS and short-form McGill pain (SF-McGill) and calf muscle length with Goniometer, measured on the baseline, after 24 hours, after 48 hours and after 72 hours.

Results: The mean age was 25.8±3.00 years, and BMI was 24.7±4.72 kg/m2 respectively. Both groups showed significant improvement ($p<0.05$) from the baseline to the end of treatment at each level of assessment. The group comparison showed that both the groups are not significantly different ($p\geq0.05$) in all variables except left calf muscle length, which showed significant improvement ($p<0.05$) in group A, at the end of treatment, as compared to group B.

Conclusion: It was concluded that individuals with post-exercise DOMS treated with theragun percussive massage increased the calf muscle length, however, no significant difference was seen in pain when compared with the static stretching group.

Keywords: muscle flexibility; muscle soreness; percussion therapy; stretching exercises.

Designation & Affiliation

[1.] Student, Riphah International University Lahore, Pakistan.
[2.] Professor, Riphah International University Lahore, Pakistan.
[3.] Assistant Professor, Riphah International University Lahore, Pakistan.
[4.] Senior Lecturer, Riphah International University Lahore, Pakistan

Citation

Rao M, Rehman SS, Hassan D, Ikram M. Effects of Percussive Massage Treatment with Theragun on Pain and Muscle Length on Post Exercise Delayed Onset Muscle Soreness of Calf Muscles in Healthy Population. T Rehabili. J. 2023:07(02); 518-524. doi: 10.52567/trj.v7i02.213

History

Received on: 26-02-2023
Revision on: 29-05-2023
Published on: 30-06-2023

Correspondence

Mehwish Ikram. Senior Lecturer, Riphah International University Lahore, Pakistan
E-mail: mehwish.physiotherapist@gmail.com

https://doi.org/10.52567/trj.v7i02.213

INTRODUCTION

Delayed Onset Muscle Soreness (DOMS) is a specific term that is used to describe the soreness that occurs after 24-48 hours of activity [1, 2]. It is caused by activities involving eccentric contraction and can be caused by lactic acid, muscular spasms, muscle damage, connective tissue damage, inflammation, and enzyme efflux [3]. DOMS are observed in both professional and amateur players. Unfamiliar and vigorous eccentric exercises are the risk factors for DOMS [4]. It is one of the major causes of poor performance in sports and it is linked to muscle soreness, weakness, and range of motion [5]. The symptoms of DOMS are prevented with a variety of conventional physiotherapeutic interventions, including massage, cold water immersion, compression garments, whole-body vibration, transcutaneous electrical nerve stimulation (TENS) and stretching [6-11].

Percussive Therapy (PT), a myofascial release technique, developed by Albeit Fulford in 1931, uses vibration to loosen up tight muscles and increase the range of motion [12]. By lowering discomfort, promoting lymphatic flow, minimizing scar tissue, and reducing muscular spasms, physical therapy (PT) is frequently used in sports to increase muscle strength and performance, decrease the risk of injuries during warm-ups, and speed up muscle recovery. PT has been found to improve passive range of motion and athletic performance, such as when dorsiflexor muscles are given a percussive massage to improve ROM and muscle performance [12, 13].

Different types of massage treatments were used to prevent DOMs and for other muscle groups [14-18]. But few studies were found on percussive therapy using theragun for the treatment of DOMS, enhancing ROM, muscle performance and flexibility in different muscle groups [19-24]. Static stretching was used for the flexibility of muscles and advised in warm-up sessions. Static stretching was used for the prevention of delayed onset muscle soreness. Static stretching is also used for the improvement of ankle dorsiflexion and used to reduce muscle tightness and increase ROM [25-27].

Only a few studies have been done on the effectiveness of percussive therapy utilizing the theragun in treating DOMS and improving ROM, muscle performance, and flexibility in other muscle groups, although multiple massage therapies have been utilized to treat other muscle groups and prevent DOMS. The purpose of this study was to determine the effects of percussive massage treatment with theragun on pain and muscle length on post-exercise delayed onset muscle soreness of the calf muscles.

METHODOLOGY

This randomized control study (NCT05026944) was conducted at the Kasrat Health and Fitness Club, Lahore, Pakistan (RCRS-RE-MSPT-SPT/spring20/076). The duration was 5 months from August 2021 to December 2022 after the approval of the research ethical committee of Riphah International University, Islamabad (REC/RCR&AHS/21/0421).

A total of n=24, age ranging from 20-30 years, healthy participants using the gym (beginners) and developed post-exercise DOMS of calf muscles, were included. While individuals with a history of lower extremity injuries in last 6 months, or muscular disorders were excluded. The sample size was calculated based on the mean difference in muscle length from a previous study. After the addition of a 20% attrition rate, the sample size of 20 was calculated [12]. The sample was collected through a non-probability purposive sampling technique.

A total of 50 gym users were screened out, as per inclusion criteria 24 were fulfilled and randomly placed into experimental (n=12) and control (n=12) groups through the sealed envelope method. From each group 2 participants were unable to follow the intervention protocol due time constraint. So the data analysis was done with 20 participants (Figure 1)

After taking written informed consent from the participants. All individuals were assessed on the Numeric Pain Rating Scale (NPRS) (r=0.76-0.96) [28], Short-Form McGill (SF-McGill) pain Questionnaire (r=0.94) [15] and goniometer. NPRS and SF-McGill were used for the assessment of pain and a goniometer to measure the degree of passive ankle dorsiflexion for calf muscle length. Group A was treated with 5 minutes of percussive massage with theragun and 5 minutes of stretching. Theragun was used in the direction of proximal to distal on the muscle belly with a tolerable range of the participants. The frequency was adjusted 30Hz by using a small head ball. 30-second continuous massage with a break of 30 sec and the total time of massage was 5 minutes [12]. Static stretching with moderate intensity was applied for 30 seconds with the rest of 20 seconds, 3 repetitions on one leg (duration 2.5 minutes) and the total duration on both legs was 5 minutes in one session. Group A total treatment time was 10 minutes (percussion therapy & static stretching).

While Group B was treated with 5 minutes of static stretching exercises only. Static stretching with moderate intensity was applied for 30 seconds with a rest of 20 seconds, 3 repetitions on one leg (duration 2.5 minutes) and the total duration on both legs was 5 minutes in one session [29]. The

https://doi.org/10.52567/trj.v7i02.213

total duration of Group B treatment was 5 minutes (static stretching). The outcome measures were assessed at the baseline, after 24, 48 and 72 hours respectively.

After the collection of data, analysis was done by SPSS version 25. The data was presented as frequency, mean standard deviation. The data fulfilled the assumption of normality. So, for within group changes, repeated measure ANOVA with pairwise comparison was used, while for group comparison at each level of assessment independent t-test was applied. The level of significance was set at $p<0.05$.

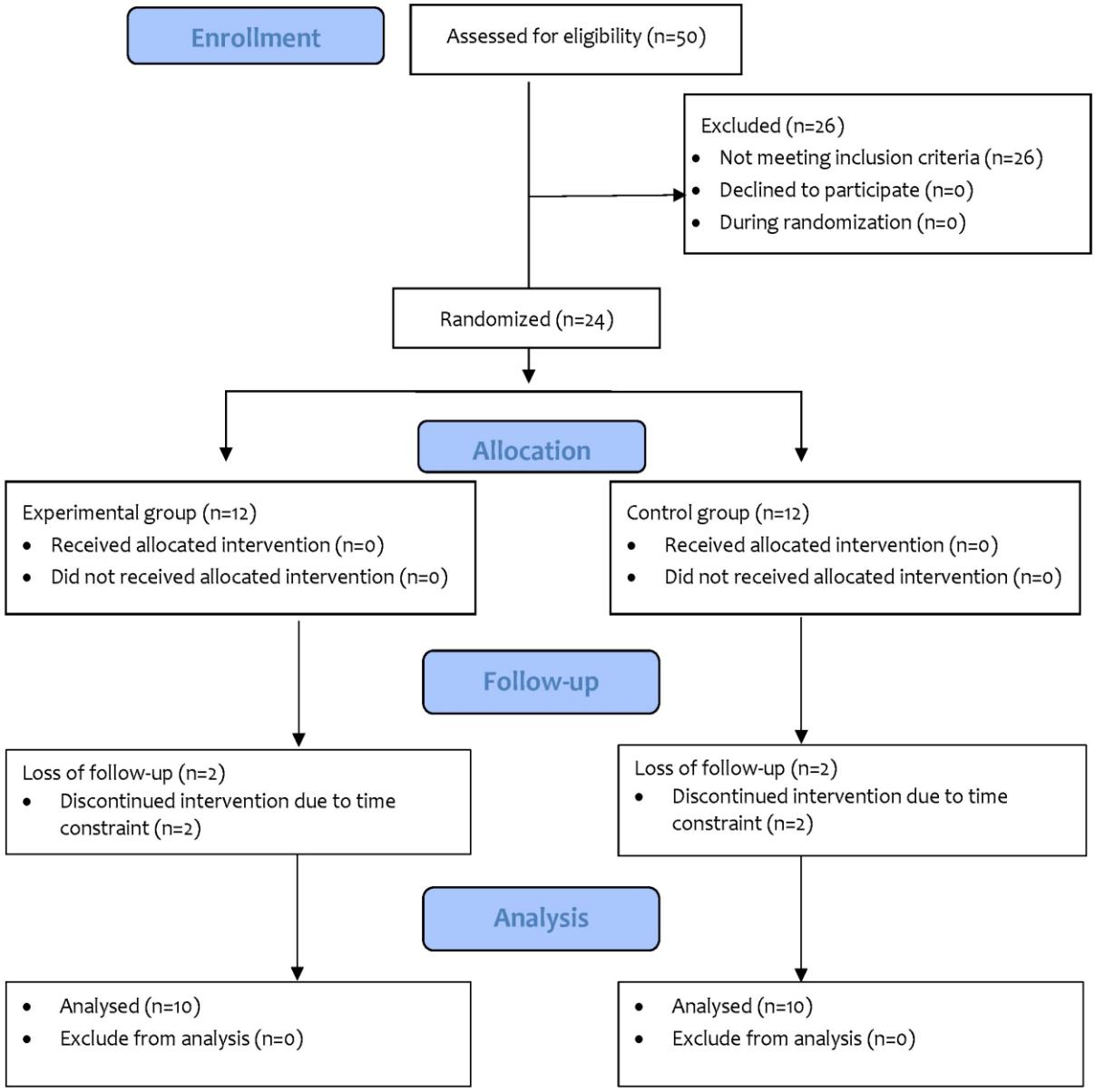

Figure 1: Consort Diagram

RESULTS

Demographic characteristics showed that the mean age, weight, height, and BMI were 25.8±3.00 years, 66.52±17.06 kg, 64.82±5.72 inches and 24.7±4.72 kg/m2 respectively.

The results showed that group A have significantly improved left passive ROM of ankle dorsiflexion for calf muscle length after 48 and 72 hours of intervention. But all other variables including pain, ROM of right dorsiflexion and pain with McGill (multidimensional assessment) were not statistically different ($p\geq0.05$) in both groups.

Within group comparison showed that all outcome measures were significantly improved ($p<0.05$) in both groups from the baseline to the end of 72 hours of the intervention. (Table 2)

https://doi.org/10.52567/trj.v7i02.213

Table 1: Between the Group Comparisons (Independent t-test)

Outcome Measures	Time	Group A	Group B	MD	p-value
NPRS	Baseline	4.10 ± 0.99	4.10 ± 0.87	0.00	1.00
	24 hr.	2.50 ± 0.70	2.90 ± 0.87	0.40	0.27
	48 hr.	1.30 ± 0.48	1.80 ± 0.63	0.50	0.06
	72 hr.	0.20 ± 0.42	0.60 ± 0.51	0.40	0.07
MC-Gill	Baseline	26.10 ± 5.98	25.66 ± 4.33	0.43	0.86
	24 hr.	14.10 ± 5.04	17.90 ± 6.17	3.80	0.15
	48 hr.	6.00 ± 3.52	10.60 ± 6.31	4.60	0.06
	72 hr.	1.00 ± 1.63	3.50 ± 3.43	2.50	0.05
ROM (Rt)	Baseline	12.30 ± 2.90	11.70 ± 3.52	0.60	0.68
	24 hr.	15.60 ± 3.13	13.50 ± 3.37	2.10	0.16
	48 hr.	17.70 ± 2.31	16.00 ± 2.44	1.70	0.13
	72 hr.	19.70 ± 1.41	18.00 ± 2.40	1.70	0.07
ROM (Lt)	Baseline	12.40 ±2.63	11.90 ± 3.28	0.50	0.71
	24 hr.	15.60 ± 2.50	13.40± 3.20	2.20	0.10
	48 hr.	18.30 ± 1.70	15.70±2.49	2.60	0.01*
	72 hr.	20.00 ±1.05	18.10± 2.28	1.90	0.02*

NPRS=Numeric Pain Rating Scale; ROM=Range of Motion; Rt=Right; Lt=Left.
Level of significance= p<0.05, p<0.01**, p<0.001****

Table 2: Pairwise Comparisons (Repeated Measure Anova)

		Group A (Theragun+ Static exercises)				Group B (Static Exercises)			
Outcome Measures		Mean±SD	MD	P-value	F(df)	Mean±SD	MD	p-value	F(df)
NPRS	Baseline	4.10±0.99	1.6[a]	.001*	102.35(3,27)	4.10±0.87	1.20[a]	.000***	73.86 (3,27)
	24 hr.	2.50±0.70	1.20[b]	.000***		2.90±0.87	1.10[b]	.007**	
	48 hr.	1.30±0.48	1.10[c]	.000***		1.8±0.63	1.20[c]	.001**	
	72 hr.	0.20±0.42	3.9[d]	.000***		0.60±0.52	3.5[d]	.000***	
SF-MC-Gill	Baseline	26.10±5.99	12.00[a]	.001**	126.8 (3,27)	25.66±4.33	8.00[a]	.000***	154.20 (3,24)
	24 hr.	14.10±5.04	8.10[b]	.000**		17.66±6.50	7.00[b]	.000***	
	48 hr.	6.00±3.53	5.00[c]	.002**		10.67±6.69	7.11[c]	.001**	
	72 hr.	1.00±1.63	25.1[d]	.000***		3.56±3.64	22.11[d]	.000***	
ROM (Rt)	Baseline	12.3±2.90	-3.3[a]	.009**	50.31(3,27)	11.70±3.53	-1.80[a]	.039*	46.26 (3,27)
	24 hr.	15.6±3.13	-2.10[b]	.001**		13.50±3.37	-2.50[b]	.002**	
	48 hr.	17.7±2.31	-2.00[c]	.013*		16.00±2.44	-2.00[c]	.001***	
	72 hr.	19.7±1.41	-7.4[d]	.000***		18.00±2.40	-6.3[d]	.000***	
ROM (Lt)	Baseline	12.40±2.63	-3.20[a]	.013*	57.96(3,27)	11.90±3.28	-1.50[a]	.028*	43.57(3,27)
	24 hr.	15.60±2.50	-2.70[b]	.001**		13.40±3.20	-2.30[b]	.004**	
	48 hr.	18.30±1.70	-1.70[c]	.004**		15.70±2.49	-2.40[c]	.003**	
	72 hr.	20.00±1.05	-7.6[d]	.000***		18.10±2.28	-6.2[d]	.000***	

[a]baseline to 24 hours, [b]24 to 48 hours, [c]42 to 72 hours, [d]baseline to 72 hours
NPRS=Numeric Pain Rating Scale; ROM=Range of Motion; Rt=Right; Lt=Left
Level of significance= p<0.05, p<0.01**, p<0.001****

DISCUSSION

The purpose of this study was to determine the effect of percussive massage on DOMS with theragun in a healthy population. Percussive massage moderately improved the calf muscle length (left side). There are always strength differences in legs we say that either it's a dominant or non-dominant leg or recovery can depend on this. In this study, no leg stance test was performed to assess leg dominance [30].

Percussive massage devices in warm-up sessions and after exercise or physical activity, prevent the delayed onset muscle soreness and increase the range of motion. It releases the tightness of muscle and fascia and improves flexibility and fatigue. Force output and muscle activation were not increased [14]. In a previous study percussive massage with a 5-minute duration was used for the improvement of calf muscles' range of motion and dorsiflexion range of motion was increased and it increases the flexibility without any effect on muscle performance of plantar flexors [12]. Percussion therapy (theragun) was tested on volley or basketball players on lower limb muscles to increase muscle power and passive ROM. In this study, a significant increase was seen in the hip and ankle while not seen in the knee [19]. As in the current study range of motion is improved with percussive massage and a significant effect was seen only on the left side. Other aspects were not studied in this study as in the previous literature, here the focus was on DOMS (pain and muscle length). It is difficult to compare its results with previous studies because percussion therapy with theragun was applied mostly to increase the flexibility and tightness of muscles.

The percussive massage was used in different muscle groups for the reduction of muscle tightness and to increase the range of motion [20]. Percussive

https://doi.org/10.52567/trj.v7i02.213

therapy with theragun was done on the quadriceps and gastrocnemius to increase muscle strength; a significant increase in muscle contraction was seen [23, 24]. In some studies, percussion therapy showed no improvement in the level of soreness between days of treatment [31].

Static stretching proved to be effective for pain reduction, and muscle tightness and was used to relieve DOMS [25-27]. But in some studies, static stretching does not produce significant effects because some DOMS which occurred due to exhaustive exercise is not influenced by static stretching [32]. DOMS (produced by extensive exercise) and pain both were not relieved from static stretching [33]. With the previous literature, percussive massage with theragun was proved to be more effective in muscle flexibility or tightness but effects on DOMS were not discussed. Massage is sometimes not proven to be effective for exercise-induced DOMS (muscle insult) and is reduced automatically after 48 hours [34]. In the current study, both groups showed significant effects at the end.

There was some limitation in this study that there was a pressure difference in pressure optimization according to the participant's tolerance in the usage of theragun frequency. Another limitation was that only female participants were involved in this study due to the gym selection. The dominant and non-dominant leg was not assessed in this study to justify the results.

CONCLUSION

It was concluded that the percussive massage technique with theragun showed improvement in muscle length and there was no change in the difference of pain results when both groups were compared. While both groups showed improvement at the end of treatment

DECLARATIONS & STATEMENTS

Author's Contribution

MR: substantial contributions to the conception and design of the study.
SSR: acquisition of data for the study.
DH: interpretation of data for the study.
MI: analysis of the data for the study.
DH and MI: drafted the work.
MR, SSR, DH, and MI: revised it critically for important intellectual content.
MR, SSR, DH, and MI: final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted after getting approval from the Research & Ethics Committee of Riphah College of Rehabilitation Sciences (REC/RCR&AHS/21/0421) and Kasrat Health and Fitness Club, Lahore, Pakistan (RCRS-RE-MSPT-SPT/spring20/076).

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

Acknowledgments

None of declare.

Funding Sources

None to declare.

Conflicts of Interest

The authors declare no conflict of interest.

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https://doi.org/10.52567/trj.v7i02.213

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https://doi.org/10.52567/trj.v7i02.213